Section 1

MANAGING SAFETY IN THE CHEMICAL INDUSTRY

P. L. Thibaut Brian
Vice President - Engineering
Air Products and Chemicals, Inc.

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All accidents are preventable, and safety can be managed. Managing safety requires molding corporate culture as well as developing superior technology. It requires building proper attitudes and safety awareness as well as conducting hazard reviews and safety audits. A total safety program is required to prevent falls from ladders and runaway reactors, cuts and burns and explosions and toxic releases. The leadership must come from the Chief Executive Officer. He must make safety his top corporate priority.

Safety is a very serious responsibility of chemical industry management and of the chemical engineering profession. Ours is a hazardous business - processing, storing, and transporting huge volumes of materials which are flammable, toxic, and explosive. Our highest priority in the conduct of that business must be the protection of our employees, our customers, our neighbors and the general public. This is an enormous managerial and technological challenge. Moving a corporation to a leadership position in chemical industry safety requires molding the culture of the entire organization. It requires penetrating attention to design, operation, and

industry have injury rates which are several hundred-fold lower than the poorest performers in the industry. Safety really can be managed.

Managing safety is just like managing sales, profits, productivity, or costs. The initiative must come from the top. When the Chief Executive Officer meets with his senior management, if he grills them a great detail about sales, profits, costs and efficiency and then as they walk out of the door he casually asks them, "by the way, how is the safety of your operation going?", you can rest assured that safety performance will be mediocre. He must penetrate into the safety record of each of his operating units as intensely as he does into overhead costs.

A very effective technique is for the Chief Executive Officer to institute a policy of having safety as the first item on the agenda of his senior management committee meetings. Any serious incident throughout the corporation should be reported promptly, and the senior line officer of the organization involved should make a presentation on what happened, why it happened, and what is his plan of corrective action to prevent recurrence. Safety must be understood and accepted to be a line management responsibility. Staff safety professionals support line management by developing safety programs, but line management must accept the responsibility for safety. Senior management should periodically review the statistics on worker injury rates, not just for the entire corporation but also for the major divisions. Inevitably, the safety performance of the best division will be found to be far superior to that of the worst, and an open review of this fact develops considerable peer pressure for improvement.

There is nothing easy about remolding the culture of a corporation, but that is what is required. In the past if an Air Products worker caused his own injury, his supervisor and higher management often took the attitude "I told him to work safely but he did not do it." Such an attitude is no longer a part of our culture. Today, a worker injury is recognized to be a management failure. Management must install the programs to prevent accidents and these include worker training and motivation and the discharge of workers who will not cooperate. Back in 1974, when we began our program, we heard many excuses from people who were slow to accept this new philosophy. You can probably visualize the various arguments we hear on why we should not

compare the safety record of an industrial gas business with that of a chemical business, or a construction activity with an operating activity, or a European operation with an American operation. None of the arguments we heard were completely without merit, but they all missed the main point. Safety achievement is, in fact, far more dependent upon management commitment and attention then upon the type of industrial activity, the geographic location, or all of the other factors so often invoked to attempt to justify mediocre performance.

Following from management commitment and attention, many safety programs must be developed in order to insure that designs are reviewed and checked, operations are documented, reviewed and checked, people are trained and retrained and motivated, and safety audits are vigorously pursued to ferret out all potential accidents just waiting to happen. In our industry a strong engineering safety effort must be a vital part of this program.

At Air Products, we have placed great emphasis on the use of formal hazard reviews of all of our operating facilities and all new plant designs. We have educated 2,500 of our personnel in the techniques of hazard analysis, and more than half of them have participated in formal hazard reviews. We believe it is beneficial to involve a large number of our people in our hazard review efforts. While most of them will participate in a formal hazard review only occasionally, this training and experience will, we believe, help them to think logically about process safety in their everyday world. We have also placed strong emphasis upon quantification of the probabilities of our major hazards, and more than 350 of our personnel have received formal education in this area. We now have a policy of quantifying the probabilities of all of the major hazards which we can quantify with reasonable confidence. We were compelled to follow this course by the shock we experienced when we quantified the probabilities of several of our major hazards and found them to be far more probable than we had perceived them to be based upon qualitative assessments.

The decision to quantify risks brings with it another challenge - one must develop a method for deciding how safe is safe enough once a risk is quantified, it is usually possible to propose ways of reducing it. The risk can never be reduced to zero, but it can usually be reduced further, inevitably with

the expenditure of more money. One is forced to decide when to stop. Our approach to making this decision is based upon the comparison of the risk in question with other risks. If the risk is large compared with the other risks involved in running our business, it is imperative that it be reduced. If the risk is quite small compared to the other risks involved in our operations, a decision is made to accept it for now and devote our resources to the reduction of our larger risks. But decisions such as these can only be made by the senior management of the corporation, and I believe that senior management must be involved intimately in this aspect of the engineering safety program.

Needless to say, risk quantification must always be applied with good judgement, and it should be viewed as a supplement to, not a substitute for engineering design standards, best industry practices, and safe design based upon long experience. Some companies may not find risk quantification to be suited to their needs, and I do not recommend it for everyone. I will say, however, that our company has found risk quantification to be extremely useful as a means of uncovering risks which are far greater than had been perceived and as a means of identifying the most effective ways to reduce those risks.

Some may question whether we can afford the cost of elevating safety to our highest corporate priority. I am convinced that the benefits far exceed the costs. In addition to the reduction in worker injury rates, our company has experienced lower costs for workers' compensation insurance, damage to plant and equipment, lost production, and liability claims. We have also experienced improved worker morale, better productivity, and improved workmanship quality. We are convinced that a first-class safety management system is a necessary ingredient in a quality management system,

In closing I wish to return to a vital point. A elaborate engineering safety effort without a total safety program is not adequate, in my judgement, to guard against major process accidents which can impact the general public. The engineering department might design the world's safest plant with the world's best safety protection systems, but if the people operating that plant and the people maintaining that plant are not highly trained and highly motivated to always do their jobs in a first class manner, to always put safety first, to always question what might possibly go wrong, and to never take

shortcuts that plant operation will not achieve the level or safety to which we aspire. This safety training and motivation involves heightening the safety awareness of everyone in the corporation. It involves modifying attitudes and always putting safety first, in the plant and in the office, in the control room, and on the highway, at work and also at home. People cannot turn on the proper safety attitude when they come to work and then turn it off when they leave for home. They cannot turn it on when maintaining the pump but turn it off when securing the ladder. They cannot turn it on when operating the reactor but turn it off when driving the truck. Proper safety attitudes can be developed to the level at which they are needed only by total safety efforts which teach and emphasize and reemphasize doing things right - so that we avoid cut fingers and broken bones and major explosions and toxic releases. That is the level of safety that society expects of us, and we can settle for nothing less.